Watershed management strategies to control cyanobacterial harmful algal blooms

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Watershed management to control cyanobacterial harmful algal blooms (C-HABs) includes activities that remove a bloom once it has occurred and activities that prevent conditions from occurring that promote and maintain blooms. Crisis response is an important component to managing active C-HABs and there are techniques that have been successfully applied including utilization of algaecides, physical removal of surface scums and mixing of the water column. These methods are valuable because the can effectively eliminate ongoing blooms, however they do not address the conditions that exist in the system that are promoting and maintaining C-HABs. Because C-HABs require nutrients to fuel their growth and are often favored in longer-residence time systems with vertical stratification of the water column, nutrients and hydrology are the two factors most commonly identified as the targets for watershed management of C-HABs. Quantities of nutrients such as phosphorus and nitrogen, and the ratios in which they are delivered from watersheds have been shown to affect C-HABs. Management strategies to control the sources, transformation and delivery of these nutrients have been applied with success in many areas. Controlling land use, maintaining the integrity of the landscape and applying best management practices are among the effective means to reduce nutrient transport from watersheds. However, few documented cases directly connecting watershed nutrient management to reduced prevalence or elimination of C-HABs exist. Watershed hydrology is often altered by consumptive water uses including irrigation, drinking water and industrial uses. Modifications to the landscape including the construction of impoundments and ditching also affect the transport of water in these systems. Management activities including the removal of flow obstructions such as dams and impoundments, and decreasing consumptive water uses can increase discharge and thus decrease residence time. Reduced residence times should make conditions less favorable for C-HABs, however nutrient delivery may also be increased as a result of the increased discharge. Comprehensive programs have been undertaken worldwide to address C-HABs in specific systems. The successful programs share many attributes which contribute to their successes. Some of these attributes include public involvement, education, solid technical justification and consideration of economic implications of the management plan. Designing effective watershed management programs to decrease the prevalence of C-HABs also requires continuing efforts to integrate science and management activities. For example, the most current scientific information about C-HABs does not always make its way to managers and conversely management programs do not always include monitoring programs that are rigorous enough to draw sound scientific conclusions. Increasing coordination among all stakeholders will enhance the effectiveness of watershed management to control C-HABs and will lead to the development of metrics of performance that are required to gauge the costs and benefits of these efforts.